In the Claims

Please amend the claims as follows:

1. (Original) A method of measuring bone condition using ultrasound waves, comprising the steps of:

a) transmitting a signal sequence of ultrasound waves for impingement on a bone being measured;

b) arranging a detection transducer configuration for receiving a portion of the transmitted signal sequence of ultrasound waves after impingement on the bone being measured; and

c) determining the degree of acoustic nonlinearity of the bone to estimate the material conditions of the bone.

2. (Original) The method of claim 1 used for detecting bone reduction and conditions related thereto.

3. (Original) The method of claim 1 used to estimate whether the bone is changing from a homogenous to a more heterogeneous structure.

4. (Original) The method of claim 1 wherein the nonlinearity of the bone is measured with harmonic frequency detection comprising the steps of:

a) transmitting a sound pulse through the bone; and

b) measuring the harmonic distortion.

5. (Original) The method of claim 4 wherein the second harmonic is sensed.

6. (Original) The method of claim 4 wherein a harmonic higher than the second harmonic is sensed.

7. (Original) The method of claim 4 wherein combinations of harmonics are sensed.

8. (Original) The method of claim 1 wherein the nonlinearity of the bone is measured with nonlinear frequency mixing detection comprising the steps of:

a) transmitting two frequencies through the bone;

b) receiving the transmitted signals; and

c) measuring the sum and/or difference frequencies in the received signal.

9. (Original) The method of claim 8 wherein the two frequencies transmitted are transmitted by two separate transducers.

10. (Original) The method of claim 8 wherein the two frequencies are transmitted by exciting one transducer with both frequencies.

11. (Original) The method claim 9 wherein the transmitted signals are received by one of the transducers that transmitted a frequency.

12. (Original) The method of claim 9 wherein the transmitted signals are received by a third transducer.

13. (Original) The method of claim 10 wherein the transmitted signals are received by the transducer that transmitted the frequencies.

14. (Original) The method of claim 10 wherein the transmitted signals are received by a second transducer.

15. (Original) The method of claim 1 wherein the nonlinearity of the bone is measured with a combination of harmonic detection and nonlinear frequency mixing detection.

16. (Original) The method of claim 15 further comprising the steps of:

a) transmitting a plurality of signals at different frequencies through the bone;

b) receiving a portion of the transmitted signals;

c) measuring the sum and/or difference frequencies of a first transmit frequency combined with the harmonics of a second transmit frequency.

17. (Original) The method of claim 15 further comprising the steps of:

a) transmitting two frequencies through the bone;

b) receiving the transmitted signals;

c) measuring the sum and/or difference frequencies of the harmonics of the transmit frequencies.

18. (Original) The method of claim 1 used in conjunction with other measurement techniques.

19. (Original) The method of claim 18 where the other measurement technique measures at least one of reflection of sound and scatter of sound.

20. (Original) The method of claim 18 where the other measurement technique measures attenuation of sound.

21. (Original) The method of claim 18 where the other measurement technique measures speed of sound.

22. (Original) The method of claim 1 used in conjunction with estimates for elastic properties.

23. (Original) The method of claim 1 used in conjunction with measurements of shape.

24. (Original) The method of claim 1 used in conjunction with measurements of geometrical dimensions.

25. (Original) A method for diagnosing osteoporosis comprising the steps of:

a) transmitting a signal sequence of ultrasound waves for impingement on a bone being measured;

b) arranging a detection transducer configuration for receiving a portion of the transmitted signal sequence of ultrasound waves after impingement on the bone being measured; and

c) measuring the degree of acoustic nonlinearity of the bone to estimate the material conditions of the bone indicative of the onset of osteoporosis.

26. (Original) The method of claim 25 further comprising the step of assigning the measured bone portion a bone strength index.

27. (Original) The method of claim 26 further comprising the step of repeatedly comparing sequential time spaced measurements of the same bone structure to identify onset or susceptibility to bone disease.

28. (Original) The method of claim 25 in which the step of measuring the degree of acoustic nonlinearity of the bone comprises:

a) transmission to achieve a two frequency mixing by transmitting two frequencies f_1 and f_2; and

b) receipt of f_1 and f_2 at the difference and/or sum frequencies f_1-f_2 and f_1+f_2.

29. (Original) The method of claim 25 in which the step of measuring the degree of acoustic nonlinearity of the bone comprises:

a) transmission of an amplitude modulated signal by transmitting a signal $p=(1+A\sin 2\pi f_m t)\sin 2\pi f_0 t$; and

b) receiving the signal at a modulation frequency f_m and $2f_m$.

30. (Original) The method of claim 25 in which the step of measuring the degree of acoustic nonlinearity of the bone comprises:

a) transmission of signals comprising one high imaging frequency f_i and one low pumping frequency f_p; and

b) receiving the signals at sum and/or difference frequencies f_i-f_p and f_i+f_p.

31. (Original) The method of claim 25 in which the step of measuring the degree of acoustic nonlinearity of the bone comprises:

a) transmission of a signal comprising one transmit frequency f_0; and

b) receiving the signal at a harmonic of the transmit frequency.

32-48. (Canceled)

49. (Currently Amended) A method of measuring bone density comprising the steps of

a) transmitting a signal having ultrasound waves for impingement on a bone;

b) receiving at least a portion of the signal transmitted after it has impinged upon the bone;

c) measuring the phase velocity of the received signal as a function of frequency;

d) determining the degree of acoustic nonlinearity of the bone to estimate the material condition of the bone; and

e) measuring the shear wave velocity of the received signal and estimating the shear modulus (□) of the bone.

50. (Original) The method of claim 49 further comprising the step of measuring the frequency dependant attenuation.

51. (Canceled)

52. (Original) The method of claim 49 used in conjunction with other measurement techniques.

53. (Original) The method of claim 52 where the other measurement technique measures reflection of sound.

54. (Original) The method of claim 52 where the other measurement technique measures scatter of sound.

55. (Original) The method of claim 52 where the other measurement technique measures attenuation of sound.

56. (Original) The method of claim 52 where the other measurement technique measures speed of sound.

57. (Original) The method of claim 49 used in conjunction with estimates for elastic properties.

58. (Original) The method of claim 49 used in conjunction with measurements of shape.

59. (Original) The method of claim 49 used in conjunction with measurements of geometrical dimensions.

60-65. (Canceled)

66. (New) A system for measuring bone density comprising:

a) a transmitter for transmitting a signal sequence of ultrasound waves for impingement on a bone being measured;

b) at least one receiver configured to receive at least a portion of the transmitted signal sequence of ultrasound waves after impingement on the bone being measured; and

c) a control system configured to determine the degree of acoustic nonlinearity of the bone to estimate the material conditions of the bone.

67. (New) The system of claim 66 wherein the acoustic nonlinearity of the bone is determined with harmonic frequency detection.

68 (New) The system of claim 67 wherein a second harmonic is detected.

69. (New) The system of claim 67 wherein a harmonic higher than a second harmonic is detected.

70. (New) The system of claim 67 wherein combinations of harmonics are detected.

71. (New) The system of claim 66 wherein the nonlinearity of the bone is determined using nonlinear frequency, the signals transmitted by the transmitter includes two frequencies and the control system measures the sum and/or the difference frequencies in the received signal.

72. (New) The system of claim 71 wherein the transmitter comprises two transducers, each one of the transducers transmitting one of the two frequencies.

73. (New) The system of claim 71 wherein the transmitter comprises a transducer that transmits the two frequencies.

74. (New) The system of claim 72 wherein the at least one receiver comprises one of the transducers that transmitted one of the two frequencies.

75. (New) The system of claim 72 wherein the at least one receiver comprises a third transducer.

76. (New) The system of claim 73 wherein the at least one receiver comprises the transducer that transmitted the frequencies.

77. (New) The system of claim 73 wherein the at least one receiver comprises a second transducer.

78. (New) The system of claim 66 wherein the acoustic nonlinearity of the bone is determined using a combination of harmonic detection and nonlinear frequency mixing detection.

79. (New) The system of claim 78 wherein the acoustic nonlinearity of the bone is determined by the transmitter transmitting a plurality of signals at different frequencies through the bone, the receiver receiving a least a portion of the transmitted signals and the control system determining the sum and/or difference frequencies of a first transmit frequency combined with the harmonics of a second transmit frequency.

80. (New) The system of claim 79 wherein the acoustic nonlinearity of the bone is determined by the transmitter transmitting signals including two frequencies through the bone, the receiver receiving at least a portion of the transmitted signals and the control system measuring the sum and/or difference frequencies of the harmonics of the transmit frequencies.